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Action-Angle variables defined on island chains ROBERT L. DEWAR, The Australian National University, STUART R. HUDSON, Princeton Plasma Physics Laboratory, ASHLEY M. GIBSON, The Australian National University — Straight-field-line coordinates are a particular case of action-angle variables, which, in standard Hamiltonian mechanics, are defined only for integrable systems. In order to describe 3-D magnetic field systems, a generalization of this concept was proposed in [1] that unified the concepts of ghost surfaces (almost-invariant tori defined by an action-gradient flow between X and O points of an island chain) and quadratic-flux-minimizing surfaces (QFMin tori, which minimize a weighted mean of the square of the normal component of $\mathbf{B}$). This was based on a simple canonical transformation, generated by a change of variable $\theta = \theta(\Theta)$, where θ is the old poloidal angle and Θ a new one giving straight pseudo-orbits (approximate field lines [2]). This was illustrated using a perturbative construction of the transformation. Investigations of this idea using the Standard Map [3], with the analog of the same constraint as used implicitly in [1] to make Θ unique, show that this constraint is not optimal, as $\theta(\Theta)$ ceases to be monotone beyond a certain nonlinearity.
[1] R.L. Dewar, S.R. Hudson and A.M. Gibson JPFR (2010) http://arxiv.org/abs/1001.0483; [2] R.L. Dewar, S.R. Hudson and A.M. Gibson CNSNS in press (2011) DOI:10.1016/j.cnsns.2011.04.022; [3] R.L. Dewar and A.B. Khotev, Physica D **85**, 66 (1995)

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